

**U.S.ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY  
540 S. MORRIS AVE., MONTGOMERY, AL 36115  
ALPBET ANALYSES**

**REPORT OF SAMPLE DELIVERY GROUP #1000029**

Project: Smokey Mountain Smelter, Knoxville, TN  
Analysis Procedure: Gross Alpha and Beta on Solid Samples  
Report ID: 100029-ALPBET  
Report Type: Original  
Date Reported: 10/20/2010  
Total Pages in Report: 20

**SAMPLES**

NAREL Sample #	Client Sample ID	Type	Matrix	Date Collected	Date Received
B0.07995U	03377 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010
B0.07996V	03378 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010
B0.07997W	03379 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010
B0.07998X	03380 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010
B0.07999Y	03381 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010
B0.08000U	03045 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010
B0.08001V	03046 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010
B0.08002W	03047 5-7 CM	SAM	SOIL	09/09/2010	09/17/2010

**EXCEPTIONS**

1. Packaging and Shipping - No problems were observed.
2. Documentation - No problems were observed.
3. Sample Preparation - No problems were encountered.
4. Analysis - No problems were encountered.
5. Holding Times - All holding times were met.

**QUALITY CONTROL**

1. QC samples - All QC analysis results met NAREL acceptance criteria.
2. Instruments - Response and background checks for all instruments used in these analyses met NAREL acceptance criteria.



**10929189**

## CERTIFICATION

I certify that this data report complies with the terms and conditions of the Quality Assurance Project Plan, except as noted above. Release of the data contained in this report has been authorized by the Director of the Center for Environmental Radioanalytical Laboratory Science and the NAREL Quality Assurance Manager, or their designees, as verified by the following signatures.

Mary F. Wisdom 10-21-10  
Mary F. Wisdom Date  
Quality Assurance Manager, NAREL

John G. Griggs 10/22/10  
John G. Griggs, Ph.D. Date  
Director, Center for Environmental Radioanalytical  
Laboratory Science

## GENERAL INFORMATION

### SAMPLE TYPES

BLD	Blind sample
FBK	Field blank
SAM	Normal sample

### ANALYSIS QC TYPES

ANA	Normal analysis
DUP	Laboratory duplicate
LCS	Laboratory control sample (blank spike)
MS	Matrix spike
MSD	Matrix spike duplicate
RBK	Method blank

### QUALITY INDICATORS

RPD	Relative Percent Difference
%R	Percent Recovery
Z	Number of standard deviations by which a QC measurement differs from the expected value

### EVALUATION OF QC ANALYSES

A method blank result is considered unacceptable if it is more than 3 standard deviations below zero or more than 3 standard deviations above a predetermined upper control limit. For some analyses NAREL has set the upper control limit at zero. For others the control limit is a small positive number.

NAREL evaluates the results of duplicate and spike analyses using "Z scores." A Z score is the number of standard deviations by which the QC result differs from its ideal value. The score is considered acceptable if its absolute value is not greater than 3.

The Z score for a spiked sample is computed by dividing the difference between the measured value and the target value by the combined standard uncertainty of the difference.

The Z score for a duplicate analysis is computed by dividing the difference between the two measured values by the combined standard uncertainty of the difference. When the precision of paired MS/MSD analyses is evaluated, the native sample activity is subtracted from each measured value and the net concentrations are then converted to total activities before the Z score is computed.

Each standard uncertainty used to compute a Z score includes an additional fixed term to represent sources of measurement error other than counting error. This additional term is not used in the evaluation of reagent blanks.

NAREL reports the "relative percent difference," or RPD, between duplicate results and the "percent recovery," or %R, for spiked analyses, but does not use these values for evaluation.

## **GENERAL INFORMATION (CONTINUED)**

### **GROSS ALPHA AND BETA ANALYSIS**

In comparison to the methods employed to determine radionuclide-specific activities, the method employed by NAREL to determine gross alpha and beta activity has the potential for greater analytical bias. This is especially true for solid samples. It should be noted that this potential analytical uncertainty is not included in the two-sigma counting uncertainty term. Therefore, gross alpha and beta results should be used as gross approximations of the alpha and beta activity present.

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**SDG #1000029**

**ANALYSIS SUMMARY**

Analysis Procedure: NAREL GR-03  
Title: Gross Alpha and Beta on Solid Samples

NAREL Sample #	QC Type	Preparation Procedure	Date Completed	Assay Batch #	QC Batch #
B0.07995U	DUP	N/A	10/06/2010	0014451Y	0007021B
B0.07996V		N/A	10/06/2010	0014451Y	0007021B
B0.07997W		N/A	10/06/2010	0014451Y	0007021B
B0.07998X		N/A	10/06/2010	0014451Y	0007021B
B0.07998X		N/A	10/06/2010	0014451Y	0007021B
B0.07999Y		N/A	10/06/2010	0014451Y	0007021B
B0.08000U		N/A	10/06/2010	0014451Y	0007021B
B0.08001V		N/A	10/06/2010	0014451Y	0007021B
B0.08002W		N/A	10/06/2010	0014451Y	0007021B
LCS-00592489F *	LCS	N/A	10/07/2010	0014451Y	0007021B
RBK-00592490Y *	RBK	N/A	10/07/2010	0014451Y	0007021B

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**PREPARATION METHOD(S) USED**

Procedure ID	Title

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**SAMPLE ANALYSIS REPORT**

Sample #:	B0.07995U	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.005e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	81.83 %	Analyst:	CHD
Ash/dry weight:	94.79 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 17:41	100.0	G54A	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	1.48e+02	3.4e+01	4.0e+00	PCI/GDRY	10/06/2010
Beta	1.65e+02	2.0e+01	1.1e+01	PCI/GDRY	10/06/2010

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**SDG #1000029**

**SAMPLE ANALYSIS REPORT**

Sample #:	B0.07996V	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.007e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	87.60 %	Analyst:	CHD
Ash/dry weight:	91.54 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 17:41	100.0	G54B	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	7.01e+01	1.8e+01	4.2e+00	PCI/GDRY	10/06/2010
Beta	1.26e+02	1.5e+01	8.9e+00	PCI/GDRY	10/06/2010

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**SAMPLE ANALYSIS REPORT**

Sample #:	B0.07997W	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.010e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	87.60 %	Analyst:	CHD
Ash/dry weight:	95.88 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 17:41	100.0	G54D	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	1.32e+02	3.0e+01	3.8e+00	PCI/GDRY	10/06/2010
Beta	1.79e+02	2.1e+01	1.1e+01	PCI/GDRY	10/06/2010



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**SAMPLE ANALYSIS REPORT**

Sample #:	B0.07998X	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.009e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	87.98 %	Analyst:	CHD
Ash/dry weight:	91.93 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 19:21	100.0	G54A	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	1.18e+02	2.7e+01	3.9e+00	PCI/GDRY	10/06/2010
Beta	1.56e+02	1.8e+01	1.0e+01	PCI/GDRY	10/06/2010

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**SAMPLE ANALYSIS REPORT**

Sample #:	B0.07998X	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.011e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	87.98 %	Analyst:	CHD
Ash/dry weight:	91.93 %	QC type:	DUP
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 19:21	100.0	G54B	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	9.90e+01	2.4e+01	4.2e+00	PCI/GDRY	10/06/2010
Beta	1.53e+02	1.8e+01	9.7e+00	PCI/GDRY	10/06/2010

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**SDG #1000029**

**SAMPLE ANALYSIS REPORT**

Sample #:	B0.07999Y	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.011e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	79.17 %	Analyst:	CHD
Ash/dry weight:	84.96 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 19:21	100.0	G54D	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	5.48e+01	1.5e+01	3.4e+00	PCI/GDRY	10/06/2010
Beta	8.61e+01	1.1e+01	7.5e+00	PCI/GDRY	10/06/2010

**U.S. ENVIRONMENTAL PROTECTION AGENCY  
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**SDG #1000029**

**SAMPLE ANALYSIS REPORT**

Sample #:	B0.08000U	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.012e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	77.42 %	Analyst:	CHD
Ash/dry weight:	87.80 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 21:01	100.0	G54A	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	4.10e+01	1.2e+01	3.7e+00	PCI/GDRY	10/06/2010
Beta	6.97e+01	9.4e+00	7.1e+00	PCI/GDRY	10/06/2010

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**SDG #1000029**

**SAMPLE ANALYSIS REPORT**

Sample #:	B0.08001V	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.029e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	79.44 %	Analyst:	CHD
Ash/dry weight:	84.28 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 21:01	100.0	G54B	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	-3.05e-01	3.8e+00	3.8e+00	PCI/GDRY	10/06/2010
Beta	-2.57e-01	2.3e+00	3.7e+00	PCI/GDRY	10/06/2010

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**SAMPLE ANALYSIS REPORT**

Sample #:	B0.08002W	QC batch #:	0007021B
Matrix:	SOIL	Assay batch #:	0014451Y
Sample type:	SAM	Prep procedure:	N/A
Amount analyzed:	1.009e-01 GASH	Analysis procedure:	NAREL GR-03
Dry/wet weight:	79.50 %	Analyst:	CHD
Ash/dry weight:	93.27 %	QC type:	ANA
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 21:01	100.0	G54D	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	7.10e+00	5.5e+00	3.7e+00	PCI/GDRY	10/06/2010
Beta	1.54e+01	4.2e+00	5.1e+00	PCI/GDRY	10/06/2010

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**SDG #1000029**

**SAMPLE ANALYSIS REPORT**

Sample #:	LCS-00592489F	QC batch #:	0007021B
Matrix:	N/A	Assay batch #:	0014451Y
Sample type:	N/A	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	NAREL GR-03
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	LCS
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 22:41	100.0	G54A	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	1.48e+01	3.3e+00	3.5e-01	PCI	10/06/2010
Beta	1.62e+01	1.9e+00	1.1e+00	PCI	10/06/2010

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**SDG #1000029**

**SAMPLE ANALYSIS REPORT**

Sample #:	RBK-00592490Y	QC batch #:	0007021B
Matrix:	N/A	Assay batch #:	0014451Y
Sample type:	N/A	Prep procedure:	N/A
Amount analyzed:	1.000e+00 SAMP	Analysis procedure:	NAREL GR-03
Dry/wet weight:	N/A	Analyst:	CHD
Ash/dry weight:	N/A	QC type:	RBK
Sample description:	N/A		
Comment:	N/A		

**COUNTING INFORMATION**

Date and time	Duration (min)	Detector ID	Operator
10/06/2010 22:41	100.0	G54B	GVJ

**ANALYTICAL RESULTS**

Analyte	Activity	$\pm 2 \sigma$ Uncertainty	MDC	Unit	Date
Alpha	-2.82e-02	3.5e-01	3.5e-01	PCI	10/06/2010
Beta	-1.61e-01	2.4e-01	4.0e-01	PCI	10/06/2010



**U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL AIR AND RADIATION ENVIRONMENTAL LABORATORY**

**SDG 1000029**

**QC BATCH SUMMARY**

QC batch #: 0007021B  
Preparation procedure: N/A  
Analysis procedure: NAREL GR-03

NAREL Sample #	QC Type	Yield (%)	$\pm 2 \sigma$ Uncertainty (%)	Analyst
B0.07995U	DUP	N/A		CHD
B0.07996V		N/A		CHD
B0.07997W		N/A		CHD
B0.07998X		N/A		CHD
B0.07998X		N/A		CHD
B0.07999Y		N/A		CHD
B0.08000U		N/A		CHD
B0.08001V		N/A		CHD
B0.08002W		N/A		CHD
LCS-00592489F *	LCS	N/A		CHD
RBK-00592490Y *	RBK	N/A		CHD

\* Samples marked with an asterisk are not in this sample delivery group but were analyzed with it for QC purposes.

**National Air and Radiation Environmental Laboratory  
QC Batch Report**

QC Batch #: 0007021B

Analytical Procedure: NAREL GR-03

**METHOD BLANKS (PCI)**

Sample ID	Nuclide	Activity $\pm 2\sigma$	Prep Date	Flags
00592490Y	ALPHA	$-2.82e-02 \pm 3.5e-01$	2010-10-06	OK
00592490Y	BETA	$-1.61e-01 \pm 2.4e-01$	2010-10-06	OK

**LABORATORY DUPLICATES (PCI/GDRY)**

Sample ID	Nuclide	Original $\pm 2\sigma$	Duplicate $\pm 2\sigma$	RPD	Z
B0.07998X	ALPHA	$1.18e+02 \pm 2.7e+01$	$9.90e+01 \pm 2.4e+01$	17.12	-1.02 OK
B0.07998X	BETA	$1.56e+02 \pm 1.8e+01$	$1.53e+02 \pm 1.8e+01$	2.09	-0.25 OK

**LAB CONTROL SAMPLES (PCI)**

Sample ID	Nuclide	Amt Added $\pm 2\sigma$	Measured $\pm 2\sigma$	%R	Z
00592489F	ALPHA	$1.74e+01 \pm 2.8\%$	$1.48e+01 \pm 3.3e+00$	85.17	-1.54 OK
00592489F	BETA	$1.55e+01 \pm 2.8\%$	$1.62e+01 \pm 1.9e+00$	104.20	0.66 OK

Analyst:

C. H. duBose  
duBose, C. H.

2006/2010

QA Officer:

K. J. McLean

10/20/10

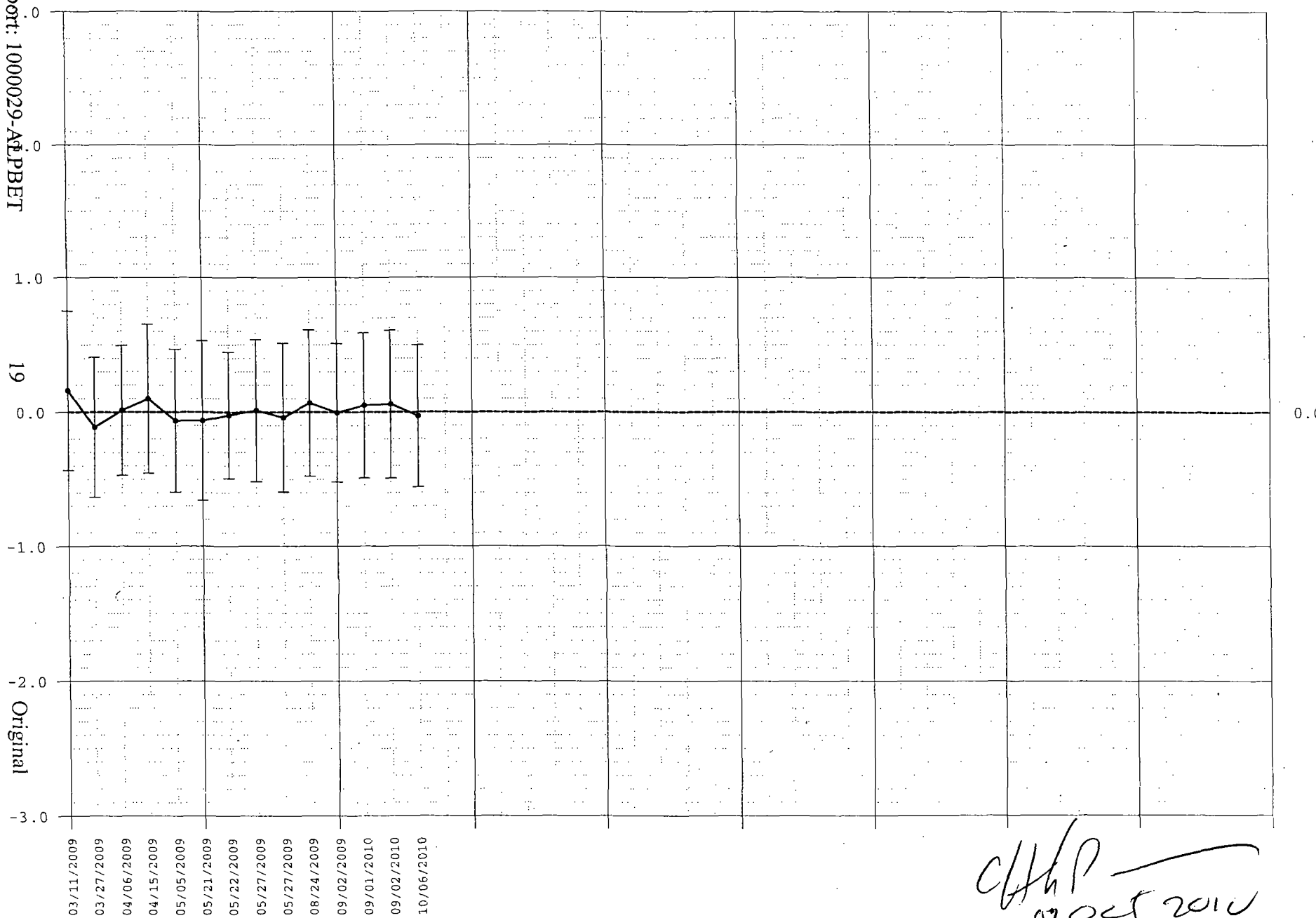
Method Blanks

Analyte: ALPHA

Method: NAREL GR-03

Analyst: duBose, C H

Report: 1000029-ALPBET



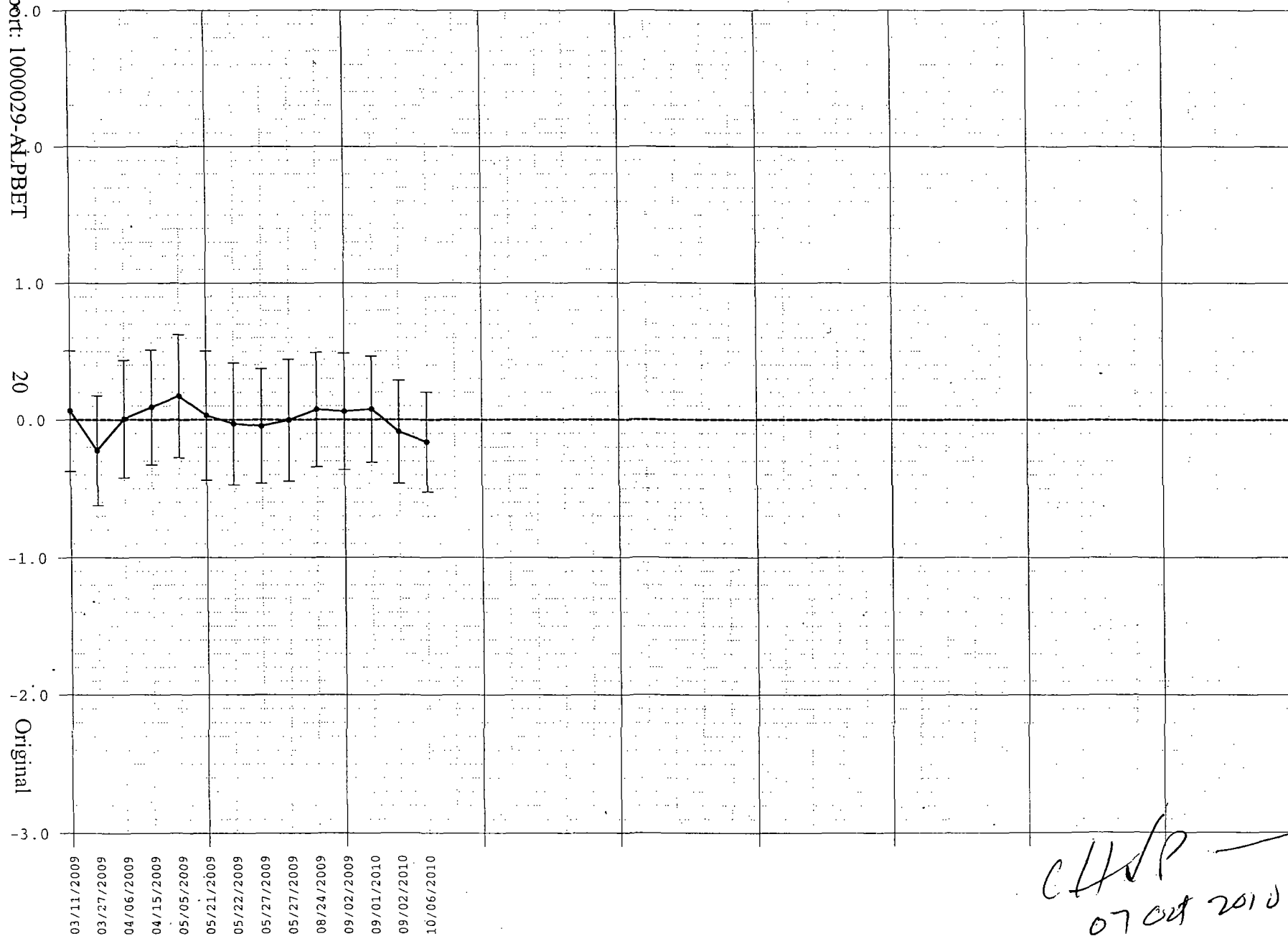
Method Blanks

Analyte: BETA

Method: NAREL GR-03

Analyst: duBose, C H

Report: 1000029-ALPBET



0.0

CHSP  
07 Oct 2010